MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

PEM0036 – CALCULUS
(Foundation in Engineering)

30 MAY 2017
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **FOUR (4) pages** including cover page and appendix with **FOUR (4) questions** only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working **MUST** be shown.
4. Only non-programmable calculator is allowed.

QUESTION 1 [25 marks]

(a) For $f(x)=\dfrac{x-7}{\sqrt{x+9}-4}$, do the following:

(i) Evaluate $\lim_{x\to 0} f(x)$. (2 marks)

(ii) Evaluate $\lim_{x\to \infty} f(x)$. (4 marks)

(iii) Determine whether $f(x)$ is continuous at $x=7$. (8 marks)

(b) If $\cos(x+\pi)\le f(x)\le \sec(x+\pi)$ for $\frac{1}{2}\pi \le x \le \frac{3}{2}\pi$. Find $\lim_{x\to \pi} f(x)$. (4 marks)

(c) Check whether the following functions have horizontal/vertical/slant asymptote.

(i) $f(x)=\dfrac{2x+3}{2x^2+3x}$ (3 marks)

(ii) $f(x)=\dfrac{x^2+5x+6}{x+3}$ (4 marks)

QUESTION 2 [25 marks]

For $y=5e^{-x^2/32}+4$, determine the following:

(Round up any fractions/roots up to 3 decimals throughout the computation)

(a) Normal line equation at $x=4$. (8 marks)

(b) Domain of the function. (2 marks)

(c) Local and absolute extreme point(s). (6 marks)

(d) Inflection point(s). (6 marks)

(e) Concavity interval (3 marks)

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QUESTION 3 [25 marks]

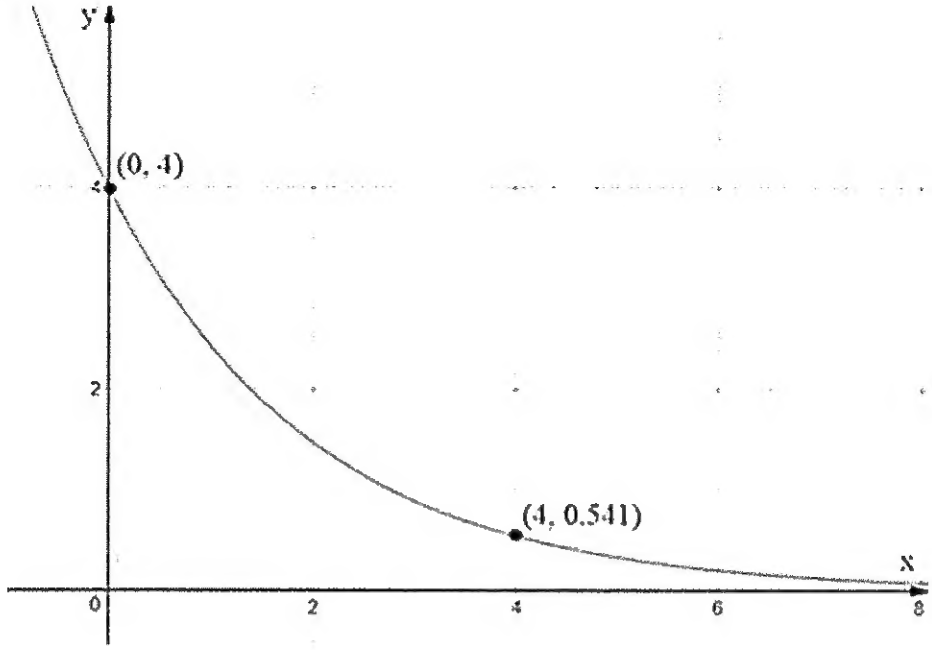

Figure 1

For **Figure 1**, determine the following:

(a) Volume of the solid generated by revolving the region about $y = 0$, if the region is bounded by $y = 4e^{-0.5x}$, $x = 0$ and $x = 4$. Use volume by disk method. (5 marks)

(b) Show that the volume in (a) also can be obtained using shell method. (Hint: There will be **two** different shell heights). (13 marks)

(c) Volume of the solid generated by revolving the region about $y = 4$, if the region is bounded by $y = 4e^{-0.5x}$, $x = 0$ and $x = 4$. Use volume by washer method. (7 marks)

QUESTION 4 [25 marks]

(a) Solve $y'(x) = 36 - 3y$ assuming that the given differential equation is a separable. (5 marks)

(b) Solve the differential equation $y' = \dfrac{4x^2 + 4y}{x}$. (9 marks)

(c) Solve $y'' - 4y' + 4y = 0$ if $y(0) = 1$ and $y'(0) = -1$. Next, verify whether the obtained solution is the particular solution of the given differential equation. (11 marks)

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APPENDIX

BASIC DIFFERENTIATION AND INTEGRATION FORMULAS

$\frac{d}{dx}[\sin x] = \cos x$

$\frac{d}{dx}[\cos x] = -\sin x$

$\frac{d}{dx}[\tan x] = \sec^2 x$

$\frac{d}{dx}[\sec x] = \sec x \tan x$

$\frac{d}{dx}[\cot x] = -\csc^2 x$

$\frac{d}{dx}[\csc x] = -\csc x \cot x$

$\frac{d}{dx}[e^x] = e^x$

$\frac{d}{dx}[\ln x] = \frac{1}{x}\ ; \quad x > 1$

$\frac{d}{dx}[sin^{-1}x] = \frac{1}{\sqrt{1-x^2}}$

$\frac{d}{dx}[cos^{-1}x] = -\frac{1}{\sqrt{1-x^2}}\ for -1 < x < 1$

$\frac{d}{dx}[tan^{-1}x] = \frac{1}{1+x^2}$

$\frac{d}{dx}[cot^{-1}x] = -\frac{1}{1+x^2}\ for -\infty < x < \infty$

$\frac{d}{dx}[sec^{-1}x] = \frac{1}{|x|\sqrt{x^2-1}}$

$\frac{d}{dx}[csc^{-1}x] = -\frac{1}{|x|\sqrt{x^2-1}}\quad for |x| > 1$

$\int \tan u\, du = \ln|\sec u| + C$

$\int \sec u\, du = \ln|\sec u + \tan u| + C$

$\int \cot u\, du = \ln|\sin u| + C$

$\int \csc u\, du = -\ln|\csc u + \cot u| + C$

$$Area = \int_a^b [f(x) - g(x)]\ dx$$

$$Volume\ (Disk) = \pi \int_a^b [f(x)]^2\ dx$$

$$Volume\ (Washer) = \pi \int_a^b [f(x)]^2 - [g(x)]^2\ dx$$

$$Volume\ (\,Cylindrical\ Shells) = \int_a^b 2\pi(shell\ radius)(shell\ height)\ dx$$

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